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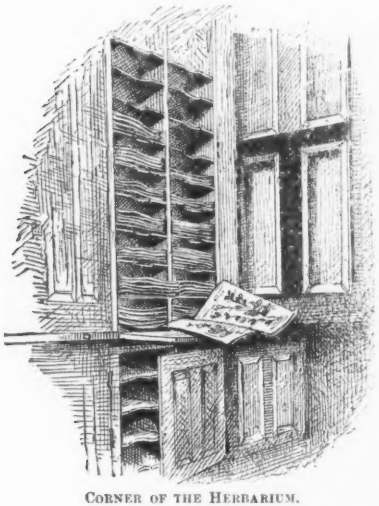
Botany in the University of Pennsylvania.

(WITH PLATES I-V.)

The year 1860 saw the United States without a single botanical laboratory. It is true that in Philadelphia there was the herbarium of the Philadelphia Academy of Natural Sciences, and that in New York City the Torrey herbarium stood open to all properly accredited students; and also in Cambridge the greatest of all American herbaria and greatest of all our systematists and best of men, Asa Gray, welcomed students who came with serious intentions. But there was nothing corresponding to the laboratories of the old world, where the whole science of botany could be studied under thoroughly trained men.



CORNER OF THE HERBARIUM.

Twenty-five years later, the condition of affairs had so changed that we had a number of fairly appointed laboratories. In earlier times, if one desired to become proficient in tracing the life histories of the lower forms of plant-life, if he wished to follow the development and evolution of tissues, or to study vegetable physiology, there was nothing for him to do save to go abroad. Such a condition of affairs, in a country whose growth and material prosperity was the marvel of the century, was not only lamentable, but it was disgraceful.

We now have not only laboratories, but we have American students, trained abroad, to direct them. One thing yet we lack. It is the full recognition of the fact that the highest function of a laboratory is to increase knowledge, and that to do this the professors should have ample time and be

relieved of most of the drudgery of teaching. This, however, is only a question of a few years; for in nothing desirable can this country afford to suffer by comparison.

The latest laboratory we illustrate in this number. It is that of the University of Pennsylvania. This is the outgrowth of a long series of very slow steps. In the early part of this century, Doctor William P. C. Barton, surgeon in the United States navy, was made professor of botany. Though he was a zealous man, and, for the times, well fitted for his work, he left almost no impress upon the teaching of the institution in botany. We can hardly think the failure is attributable to him.

In the year 1865, the late distinguished George B. Wood, with a liberality as rare as it was praiseworthy, partially endowed, under the title of the Auxiliary Faculty of Medicine, five chairs. Among these was one of botany. It is true that neither the salary nor the duties of the incumbent were very large. His pay never, under the endowment, exceeded five hundred dollars a year, nor was he expected to do more than deliver thirty-five lectures for that sum. It is true, all that the professor of botany did beyond this was fully appreciated by the authorities, but it can hardly be said to have opened any avenue for promotion, because no avenue was possible under the circumstances.

The first professor of botany under this endowment was Horatio C. Wood, M. D., who was then distinguishing himself as a pioneer fresh-water algologist, and who afterwards won even higher honors in the field of materia medica and therapeutics.

Professor Wood resigned his position in 1876, and Dr. J. T. Rothrock was, on the suggestion of Professor Asa Gray, chosen to succeed him. The liberality of the late Eli K. Price made it possible to obtain some dissecting microscopes and to open a laboratory for analytical work. Beyond this nothing could be accomplished, until the year 1881, when the University, recognizing, at last, the need of more extended botanical instruction, established a full chair of botany, and undertook to provide a course of instruction preparatory to medical study. The idea was a good one, but there were insuperable difficulties in the way of its largest success.

In 1883, the accident of two ladies (one coming from China) desiring to study the natural sciences in Philadelphia, and finding in that great city of a million inhabitants no place where they could receive regular instruction, opened the

eyes of the community to its educational shortcomings. Funds were at once raised for a Biological school under the auspices of the University of Pennsylvania, in which the same privileges were to be accorded to both sexes. This was the very foundation-stone, the leading principle, out of which the new movement took final shape. It should also be added, it was fortunate that Prof. Horace Jayne, M. D., was made secretary. But for the gift of his time, his executive ability and his money, the fullness of hope might have been long deferred.

Plate I gives a northern view of a three-story brick building, 82 x 47 feet. A glance will show that, though nothing has been wasted upon mere architectural effect, the more important consideration of light for work has been fully considered. We may also add that upon its heating arrangement and water supply great attention has been bestowed.

Plate II shows the interior of the laboratory of general biology, seen from the east. This room, capable of seating fifty students comfortably, and providing for all the appliances of work, is now regularly filled with an attentive and promising class derived from the biological and veterinary schools; from the college and from the auxiliary medical course. The same room is used for general biology and for botany. In other words, it is the work-shop of the first-year students. The advantage of this plan is that each student can thus receive a simple and a compound microscope, a full set of staining and micro-chemical reagents, and be held strictly responsible for them. Each man has exclusively the key to a safe-lock closet. On entering, he deposits a moderate sum to cover breakage, etc. After deducting his indebtedness, the remainder is returned to him at the end of the season.

The long gas-pipe seen overhead and the jets along the front wall supply to each worker means of applying heat or receiving light as he may require.

In the first term of the first year the entire class attends the laboratory instruction of Prof. W. P. Wilson on the gross anatomy of plants, and later on receives lectures upon the elements of vegetable physiology from the same gentleman. He also gives instruction upon describing plants.

In the second term of the first year the students have instruction from Prof. J. T. Rothrock in analysis of our common plants. This work is, by choice, on dried plants. The systematist in botany will always be obliged to do much of

his labor from similar material, and it is well worth the while of the student to learn how it is done.

The botany of the first term of the second year is histological and physiological. For this class a special laboratory is provided, adjoining the room where the general work of the second year is done. Plate III shows, unfortunately, but a corner of the physiological laboratory. Here one finds abundance of aquaria, large and small, the usual supply of tubing, test-tubes, air-pumps, etc. In fact, the desire is to furnish whatever is needed for working out the usual problems of this stage of botanical study. Prof. Wilson has arranged a very satisfactory course of practical instruction in this direction.

The physiological laboratory communicates also with the greenhouse (Plate IV), in which abundance of fresh material is found.

The second term of the second year brings the student to Prof. Rothrock for some of the practical aspects of botany. He may decide for himself what direction his study shall take. Most of the students prefer medical botany, as it is directly in the line of the profession into which the vast majority of them ultimately go. Or the opportunity is given for close study of different kinds of work, or the student may prefer *general economic* botany.

There are beside special rooms provided for these advanced students who are capable of doing original work.

Miss Emily L. Gregory, who is so well known to the readers of the GAZETTE, is now engaged in pursuing her investigations in this building. Plate V shows one of these laboratories for special workers.

In the building there is a very complete local herbarium, the gift of Mr. Isaac Burk. The herbarium owned by Prof. Rothrock is here and available for purposes of study. It has a value from the large number of the type specimens of our western species which it contains. Among them are found sets of the collections made by the earlier government explorations west of the Mississippi. Also those of Bolander, Parry, Hall and Harbour, Lemmon, Palmer, Rothrock and Pringle. The small illustration heading this article shows a corner in the herbarium.

The student also has access, under proper restrictions, to the facilities for study offered by the Philadelphia Academy of Natural Sciences. The library and herbarium of that institution are among the most valuable in the country.

The botanical garden is now fairly started, and already

adds very considerably to the teaching resources of the institution. Steps are being taken for its immediate enlargement.

The advances made in the recent past by the photographic art suggested that the biological school should not only have a place provided where it could take advantage of the help there afforded in illustration, but where photography, as applied to scientific work, could be taught.

During the past season the results in this direction have amply confirmed the opinion as to the value of photography in botany, both for reproducing microscopic appearances and for the larger visions of field work.

Development of cork-wings on certain trees. IV.

EMILY L. GREGORY.

Physiology.

The question of function can only be raised here, in case this peculiarity of structure is sufficiently emphatic to render it probable that some special object is to be gained from it. Assuming this to be true, the difference in the morphology of the three kinds described suggests a corresponding difference in function. In connection with this, two important principles held by scientists of the present day are to be considered. First, that no peculiarity of structure in living organisms is supposed to exist without adequate cause. For example, the wings of Euonymus alatus, which appear to the ordinary observer as useless if not cumbersome appendages, may be accounted for as a result of an effort on the part of its ancestors to accommodate themselves to their environment. According to this, it is not necessary, however, to show that an organ which proved advantageous to the ancestors of this plant is of equal service now to the offspring, unless it can be shown that the circumstances which called it into existence are still unchanged.

The second principle is that nature is extremely sparing of material; that of all the various means made use of to attain an end, those requiring the least outlay of material are the ones retained, and peculiarities of structure arising in harmony with this principle are the ones transmitted by inheritance.

Assuming the validity of these two principles, it would seem a proper question to ask: Of what use to these plants

are these corky outgrowths, and is the advantage secured commensurate with the outlay of the material? It is not claimed, however, that the results of the present investigations are such as to render possible a satisfactory answer to these questions. It is hoped that the few thoughts which have suggested themselves in this connection may be of some slight value.

The earlier researches made on the subject of cork seem to have fixed its use in the plant economy, as that of protection, mainly in the way of a substitute for epidermal tissue. This certainly is the office of periderm, both superficial and internal. Later investigations have somewhat broadened the meaning of the word; cork tissue has been defined,[1] "Not simply the tissue produced by cork cambium, but all parenchymatic cells which produce resin and which have a corky membrane, in general every cell which has a corky membrane." Accepting this definition, we must include as part of its function the repairing of tissues torn or broken by external or internal causes and aiding in the regulation of gases and transpiration.

We have already referred to Höhnel's division into phelloid and real cork-cells; to the former he gives two functions—first, to separate the bark from the stem, "Trennungsphelloid;" second, to take the place of the real cork, "Ersatzphelloid." According to the strict definition of bark, the first function can not be ascribed to the phelloid of the wing, nor, in fact, to that of any found in the superficial periderm. The second function means nothing unless we are able to decide what use the real cork would be to the stem if occurring in the same place.

Sections of the various kinds of wings were subjected to the usual tests for suberin, with varying results in the same species and sometimes even in sections cut from different places in the same plant.

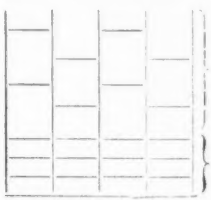
Sections of Liquidambar thoroughly heated in Schulze's macerating fluid and then treated with chlor-iodide of zinc, showed the following results: In no single case did all the summer cells show the pure ligneous reaction. The walls of some of these cells contained more or less suberin. In three or four experiments in which a large number of specimens were treated, the greater number of these cells were ligneous. Especially was this the case with the early summer cells of each year. This indicates that these cells are not lignified, if at all, until they reach some distance from the phellogen layer. The plate cells always showed the

[1] By E. Adlerz. See abstract in Just's Jahresbericht, XI (1883), 525.

suberin reaction. Several cases showed no inclination to the ligneous reaction; summer, as well as plate cells, appearing to be true cork, except along the edges where the break occurred. All along these edges the walls of the exposed cells and those lying next to them were colored a bluish purple, the color diminishing gradually in intensity toward the central portion of the wing. This is a noticeable and significant fact. In almost every specimen tested the outer edges were not suberized. This was not due to careless testing, as might be supposed, only enough of the chlor-iodide of zinc being used to affect the edges, for the sections were treated freely with this without a cover glass, and the reagent was dropped carefully on the center of the wing before it was allowed to reach the edges. The summing up of five or six sets of experiments is as follows: the tendency is for the summer growth to form ligneous walls, plate cells always cork.

In Quercus the results were very similar. A few specimens showed no ligneous tissue, several only at the edges along the lines of fracture, and still others gave a pure ligneous reaction throughout the entire summer cork. The same may be said of Acer campestre.

In Acer monspessulanum the results were the same, except here there were always ligneous cells along the line of breakage. Euonymus alatus differed from the preceding only in that the tendency to ligneous cells in the summer growth was more marked. A few words in passing here with reference to the morphology of these cells. In all examples studied, in case of the summer cells, the radial walls were met by the tangential ones about in the center of the cell, while in the plate cells the tangential walls were so cut off from each phellogen cell as to meet each other, thus forming a continuous line around the circumference. (See diagram.) This construction of the summer cells is mentioned



by Gerber[2] in reference to the outer cork layers of certain trees, which layers are stretched by the growth of the wood and phloem tissues inside. In the case he cites, this construction is accounted for on the ground of its allowing this stretching in the direction of the circumference, the radial walls bending so as to form a zigzag line when looked at from a

[2] A. Gerber. Die jährliche Korkbildung im Oberflächenperiderm einige Bäume. Sitzbericht der Naturf. Ges. zu Halle, Jan. 12, 1888.

cross-section. This line, according to Gerber, indicates the degree of tension produced by the pressure of the new cells growing within the zone of cork cells. Now, the significant fact in connection with this in the cork wing is, there is no such tension from pressure of the growth within, because the constant breaking of tissue from the outside prevents it. The cells, which are arranged for this purpose, keep their rectangular form. The plate cells of the fall growth, which form a connected zone about the stem in Quercus and Acer and in Liquidambar connect with the regular periderm of the rest of the stem, have not this contrivance for stretching, and it may be supposed are more easily broken by the pressure within when the sudden and vigorous growth of spring begins. On the other hand, it was found that in the majority of specimens the walls of the plate cells were decidedly thicker than those of the summer cells, and in nearly all cases both radial and tangential walls were bent and curved.

In the formation of the wings of Quercus and Acer and others of a similar type, the first steps in the process are easily explained on the score of purely physical causes. The breaking of the tissues is the result of the strain, greater here than in other places, on the fresh yielding tissues. The increased rapidity of growth following this breakage is not unlike that caused by a wound external. Very soon, however, in Acer there is a change in the place of growth; that portion exposed by breakage to the more free action of the air is soon built out, so that many layers of cells occur between the phellogen and the external portion. (See *a* in fig. 3.) No reason suggests itself for the change in the place of rapid growing to the center of the wing, except the one which may be used when all others fail, namely, inherited tendency in this species. With Quercus this change of base in growth either does not occur or is much more gradual. As to the question of possible or probable advantage to the plant in these two examples, a few words on the function of lenticels are necessary.

In general they are held to be to the superficial periderm what the stomata are to the epidermis. Notwithstanding the thorough investigations made of these organs at different times, there still appears to be some question in regard to their exact mode of action in all cases where they occur.

Haberlandt[3] says that in case of green stems without per-

[3]G. Haberlandt, Beiträge zur Kenntniss der Lenticellen. Sitz. berichte der k. Akad der Wiss. in Wien. Bd. 72. 1875.

iderm, when lenticels occur, they serve to hinder transpiration, on stems with periderm they increase it. Zahlbruckner[4] says, in winter they are permeable for air only in slight degree, in spring they are fully open, that is, in a condition to allow exchange of gases freely before the leaves have reached their growth. Klebahn[5] says, a winter closing of the lenticels does not exist, and that their permeability for gases in certain plants is the same both in summer and winter, in others, greater in the early part of summer.

One glance at the anatomy of the wing of Quercus macrocarpa and of Acer will suggest the possible connection here. The lenticels are raised by the rapidly-growing wings until they are separated entirely from the cells within the phellogen layer which they are supposed to furnish with air. Finally the outer cells break in regular lines along the corners of the stem, and during the first year, all along these broken places, free communication between the phellogen cells and the outer air is hindered only by the thin cellulose walls of one or two layers of cells. We say cellulose; we have proven that these walls are in no case suberized; they may be slightly lignified, but even in this case would offer less resistance to the interchange of gases than the suberized upper wall of the epidermis.

We then have the furrow between the wings acting as a continuous lenticel, in a less degree permeable, but still rendering an interchange of gases possible. Now as winter approaches this furrow is closed, in every case, by a few layers of real cork cells whose walls are suberized. In the spring this zone of cells is broken, the same conditions are renewed as in the preceding summer, as regards interchange of gases.

The probability that these furrows serve the plant in this way is increased in the case of Quercus by comparing its superficial periderm with that of Quercus suber. In the latter, the presence of the large and numerous lenticels, extending from the phellogen layer nearly to the surface of the thick periderm, and communicating there with the external air by means of shallow cracks along the surface, shows conclusively that the inner portions of the stem need to be in communication with the outside air. These lenticels are entirely wanting on the stems of Quercus macrocarpa. De Bary[6] states that lenticels lie in the furrows of the wings of Acer campestre, Euonymus Europæus, Ulmus and Liquid-

[4]Abstract in Just's Jahresb. XII. (1884) part 1, p. 265.

[5]H. Klebahn. Jenaische Zeitschrift für Naturwissenschaft, 1884, p. 588.

[6]Anatomy of Phanerogams and Ferns, p. 562.

ambar. This passage is given in explaining a sort of converse to the usual form of lenticels, that is, convex externally.

I have been unable to harmonize this statement with the examinations made. In no stems of Acer campestre under three years of age were any lenticels discovered between the wings; in fact, the anatomy given of the first and second year's growth seems to preclude the idea of lenticels forming in this position. If occurring in this place, in any of the stems available for examination, it must have been on stems so far advanced in age as to have lost the peculiar winged appearance. Such stems were not examined. It is still more difficult to understand the meaning of this passage in case of Liquidambar and Euonymus Europæus. There is here no question about the position of the lenticels. As already explained in the anatomy, the wings of Liquidambar occur, at first, as a single ridge, under a row of lenticels on the upper side of the stem, which afterward splits open along the line of opening of the lenticels, in many cases the break extending quite to the phellogen cells. During this growth there is a large portion of the circumference of the stem not affected by the wing formation; over this are scattered the convex lenticels, which are in no way different from those on stems without cork. None were discovered between the wings in any other sense than this, and there are certainly no exceptions to the usual convex lenticels.

In Euonymus Europæus, the wings are at the corners of the stem, and between them are broad spaces covered with epidermis, which is plentifully supplied with stomata. These soon pass from that stage into that of corky excrescences, which, examined after they are considerably developed, appear to consist of the same tissues as the wing.

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The "King-Devil."

LESTER F. WARD.

On the 24th of August, 1879, as I was returning from a hunting excursion of two weeks in the "North Woods" which flank the Adirondack mountains on the west (my own game having been entirely of a vegetable nature), to Evans'

Mills, in Jefferson county, New York, where the party was fitted out, we passed through the little town of Carthage, and before having fairly left the town I espied from the wagon an unfamiliar weed growing by the roadside. Leaping from the wagon, as I had done a hundred times before, and plunging my garden trowel under it I brought it up with a clod of earth which I shook off as I ran on and regained the wagon. I immediately recognized it as an Hieracium, but quite distinct from any of our native species, with all of which I thought I was familiar. The first glance made me very desirous of obtaining more, but a down grade with good road started the horses on a fast trot and I saw two or three specimens go by before I was able to obtain another without begging the driver to stop for the purpose and seeing him stare impatiently at me, as he, at least internally, cursed me as an incorrigible "crank." At length our speed slackened and I succeeded in obtaining one more specimen in the same manner as before.

I examined the specimens carefully, shaking my head as I placed them in my swollen portfolio, and resolved, that, if possible during my stay in that section, I would obtain more of the plant. Accordingly, on the following day, I gladly accepted the invitation of Mr. Jerry Walrath, since deceased, who was with our party, and a very pleasant gentleman, to take me a long ride around the country in the vicinity of Evans' Mills, which is chiefly noted as the site of the settlement on Pleasant creek, some three miles above that place, of the early French Le Ray family, the heirs of which preserve the estate almost like a park. I was, I confess, thinking all that day, which I remember with much pleasure, more of my new hawkweed, which I believed to be a modern immigrant from the continent, than I was of the more ancient immigrants about whom my friend so intelligently discoursed. At every fence corner and in every lane I scanned the ground, hoping to see it, until, as Thoreau says, the earnest searcher after a particular plant, the image of which has long been in his mind, will eventually do, I at last espied it, not, however, in isolated individuals growing by the barren roadside, but in a large colony, growing compactly together, the radical leaves in prostrate rosettes, forming an almost unbroken mat upon the ground along both sides of a fence that bordered a plowed field. The area was restricted, it is true, to a few rods in length, and to one side of the road, but it looked as if, prior to the last plowing of the field adjoining, it might have

extended some distance inward. The plants were smaller and slenderer than the ones I had seen at Carthage, and it was a moment before I became certain of their identity. They represented all stages of advancement, from the buds to the ripening head, and I observed the light akenes, with their feathery pappus, detaching themselves from the plants and being borne away by the wind. I distinctly remember saying to Mr. Walrath, who, as I had told him what I hoped to find and he had seen me get the Carthage specimens, manifested a genuine interest in the matter, that if the farmers of that section did not take measures to prevent it, that plant might become a great pest, a remark which, I doubt not, if he were living, he would also recall. The particular spot where I found the plant on that day was some three miles northeast of the village of Evans' Mills, on the farm of Mr. John Evans, a descendant of the early family who gave their name to that place.

I took a goodly number of specimens and brought them back with me to Washington, where, at the herbarium of the Department of Agriculture, I carefully compared them with all the species of Hieracium there represented, and concluded that they agreed better with *H. fallax* Willd. and *H. præaltum* Vill. than with anything else I could find. I sent specimens both of the Carthage and the Evans' Mills collections to Dr. Gray, stating some of the circumstances, and writing on the labels the names of the two species that I thought lay nearest to my plant. I am unable to recall the exact nature of his reply, but I am certain that it was not final and that he desired time to investigate the subject. Getting no further word from him, I distributed most of the specimens under the name "*H. fallax* Willd."[1] When Part I of Vol. II of Gray's Synoptical Flora appeared, my attention was called to the credit given me on page 424 for the discovery of the plant in this country. It is, as he cautiously remarks, "a form" of H. præaltum, and I shall presently note the principal points of divergence from the type of that species.

As is the habit of romance writers, I must now ask the reader to figure to himself the lapse of a considerable length of time, viz., eight years. After the smoke of the great bat-

[1] I wish to say here that, through some curious inadvertence, I now possess neither of the specimens collected at Carthage, and to ask any of my old correspondents to whom I sent the plant (the Harvard Herbarium excepted), who may chance to read these lines to take the trouble to look and see if his specimen is labeled from that place, and let me know if it is, as I would be glad to know where these specimens are.

tle, which was called the Cleveland meeting of the American Association for the Advancement of Science, was over, I retired, begrimed and discomfited, to the classic banks of the St. Lawrence, where the winds, though sometimes brisk, are not laden with carbon, and where some members of my household had gone before me. The night of my arrival I heard through them that a botanist from Albany had recently visited Evans' Mills and Carthage in search of a plant that he said I had found there, that he had called on Mr. William Comstock, an intimate friend of mine, and who had been the life of the hunting party above alluded to, and questioned him concerning it. I immediately had my suspicions as to what plant it was, which were fully confirmed a few days later when Mr. Comstock and his wife came from their home in Evans' Mills and spent a day with us at the Central Park. I learned from them that the gentleman's name was Peck, and I at once knew that it could be none other than Prof. Charles H. Peck, State Botanist of New York. Mr. Comstock related to me the interview with Mr. Peck as nearly as he could remember it; that he was in search of a plant that I had once collected at Evans' Mills and Carthage, that the plant was a "hawkweed," etc. Mr. Comstock said he told him that there was a hawkweed growing there on all the farms which was a terrible pest to the country and had gained the name of Devil-weed, King of Devils, or, more briefly, the King-Devil, but that this could not be the rare plant he was in search of, because it was so extremely abundant, and, besides, it flowered in June, and I had collected my specimens late in August. He further said that, unable to find the plant at that place, Prof. Peck had secured a conveyance to Carthage, and that he understood from the party who drove him there that he also failed to find it there.

The narrative interested me intensely, and I did not hesitate long in accepting the invitation of my friend, Mr. Comstock, to come and spend a little time at Evans' Mills, and to go about the country again. To be brief, I spent the most of two days (September 5 and 6, 1888) almost exclusively in the investigation of this question. One hour after arriving there I satisfied myself that the King-Devil was none other than Hieracium præaltum, which, as I had predicted, had been sown broadcast by the wind over that entire section of the state, and had now become a veritable terror to the farmers. We traveled over much of the worst infested region and found no one who did not know perfectly well what

the King-Devil was. It forms a continuous mat of pale green leaves lying flat on the ground and preventing any other form of vegetation from taking root. In June it sends up a scape, or, more properly, an almost leafless, more or less branching stem, bearing a large number of flowers in a panicle, which quickly ripen and permit the achenia to be scattered by the wind. The stems then die and turn brown, but persist in an erect position, the leaves at the base remaining green, thickening and multiplying and the plants spreading by suckers as well as by seed. This last I proved by securing specimens with two distinct plants attached by the subterranean rhizome.

Notwithstanding this date of normal flowering, I was not disappointed in my attempts to procure good specimens. As the inhabitants well know, the King-Devil sometimes yields two crops of seed. By this is meant that fresh flowering stems will occasionally spring up in late summer, apparently always from plants that did not fruit early in the season. But, as far as my observation went, this was sporadic and comparatively rare. In fields infested with the plant it was difficult to find such autumnal bloomers, but they occur in considerable numbers standing more or less isolated along the roadsides and at other places where there is little or no vegetation. In this condition they could be found at the time I was there, growing very large and thrifty, in all stages from early budding to mature fruiting. My undue zeal led me to collect a very large number of fine specimens, and this is perhaps the place to say that these specimens are for free distribution to any that may desire them.

I made careful inquiries, first, as to the local origin of this noxious weed; secondly, as to the date of its first appearance; and thirdly, as to the exact extent of its present distribution.

To the first of these inquiries I received the almost unanimous answer that it was first seen on the farm of Mr. John Evans, and that from this point it had spread only in an easterly or southerly direction, owing to the prevalence at the time it is in fruit of westerly or northerly winds. As to the second inquiry, while I found those who stated that it had been known near this point of origin for fifteen or twenty years, the consensus of opinion seemed to be that it had not been regarded as a pest for more than seven or eight years. This last is certainly true, for had there been any such noxious plant in that vicinity in 1879 I should have heard of it,

and had it been known then as it is now, I should have been derided for getting off a wagon to dig a specimen of the King-Devil. May it not be that, after a day's search, I found it on that occasion at or near the very nest in which it was first hatched in the United States? I revisited that spot and found it still holding its own, but it had then spread in all directions, and could be found in every lane and by every fence in all that section of Le Ray township.

With regard to its present distribution I could obtain much less satisfactory information. I was told that it had swept a tract of country from five to ten miles wide, but as to the length of this belt no one was able to give any definite idea. Carthage would be immediately in its track, but this is only a distance of fifteen miles. Finally, not having investigated other parts of the state, I am not, of course, prepared to say whether this is really its center of distribution, or whether it may not be equally destructive to other sections, but I incline to believe that such is not the case. It is one of the legitimate questions for the state botanist to investigate, and whenever he shall do so I shall be very glad to learn the result. I am certain that it does not occur among the Thousand Islands or along the St. Lawrence river adjacent, having just spent ten days in studying the botany of that section, with my attention specially drawn to the subject; but the nature of the country here is such that it would scarcely be expected to grow, even if introduced. I met a young man named F. W. Barnes, who resides at Auburn, and who told me that a similar plant, but with purple flowers, was found in that vicinity. At my request, he has sent me a specimen since my return to Washington, which proves to be *H. aurantiacum* L., thus showing the accuracy and clear discrimination of Mr. Barnes, to whom I desire here to express my thanks publicly, as I have already done privately. I have since corresponded further with Mr. Barnes, and he informs me that he knew of this plant only in one place near Auburn, where, as the owner of the land informed him, it had been known for twelve or thirteen years without tending to spread, because it had been prevented from going to seed. He understands that plowing it under kills it. He says that he has never seen the King-Devil in that section of the state, but that he once saw it at Napanee, Ontario, thirty-five miles west of Kingston. If there is no mistake in this last observation, it is a very important fact, and will require us to look still farther westward for the first starting point of our un-

welcome immigrant. May it not have been originally a ballast plant of some Canadian port, as Toronto, for example?

Another question to which I gave some attention was that of how this modern intruder can be destroyed or expelled. About the only remedy that had been tried was that of salting the places infested with it. This, if thoroughly done, kills the plant, but it also kills everything else. It is expensive, and can only be successfully practiced in cases where the plant is still confined to comparatively small spots. If taken in time it can be temporarily kept from a given territory in this way. Its habit is to spread by small colonies, which, if left undisturbed, will eventually become confluent and cover entire fields. A single seed would probably produce one of these colonies in a few years, the original seedling propagating by underground stolons through a succession of generations, and thus working out radially in all directions. I visited the portion of Mr. J. P. Steinhilber's farm, where salting had been practiced some months previous, and saw that it had for the time being destroyed all vegetation, but, singularly enough, I found growing in the middle of the area thus blasted several large autumnal specimens of the King-Devil in fine condition for the botanist, two of which I collected and have specially labeled. No other vegetation whatever had sprung up on this sterilized soil. Mr. Wayne Stewart, whom I was unable to meet personally, has conducted the experiment of salting on a large scale, and is said to regard it as a success. After having been destroyed in this way the plant will not reappear until again seeded by the wind from other parts.

The only other remedy I heard of was simply to plow the plants under, when a crop may be raised upon the ground thus plowed, and many of the roots will be killed. The subject should certainly be investigated scientifically at the State Experimental Station and means devised, if possible, to prevent the further spread of so dangerous an enemy of the agricultural industry of the state of New York.

The species *Hieracium præaltum* was originally named by Dominique Villars in F. C. Gochnat's Tentamen medico-botanicum de plantis Cichoraceis, 1808. De Candolle, in the Prodromus, enumerates five varieties, but he treats *H. fallax* Willd., with its three varieties, as a distinct species. These are now generally regarded as simply varieties of *H. præaltum*, having the leaves somewhat narrower and acute, more or less white-tomentose beneath and the stem sparing-

ly pilose. Some of the varieties occasionally bear stolons above ground, but this is never the case with the New York form, although, as already remarked, subterranean suckers are common. With the exception of the white-tomentose under surface, my specimens would perhaps fall more nearly under the section *fallax*, but in the absence of this character I am disposed to refer them to some of the original varieties of De Candolle, although this is somewhat difficult. The variety *hispidulum* of Froelich is much the nearest, this having the base of the scape and also the leaves pilose-hispid. In our plant there are frequently, but not always, strong and very long white hairs on both surfaces of the leaves as well as along their margins, but those on the scape are very few and mostly near the base; they are also quite short. The whole plant, except the dark glandular hairy involucre and pedicels, is light green or glaucescent. There are usually two small leaves on the stem, the upper of which, however, subtends the lowest branch, and the other branches are provided with smaller bracts. A minute black ring or speck encircles the base of each hair, and many such occur where the hairs are no longer present.

In the investigation of this plant and the numerous interesting questions arising from its singular advent and diffusion in that section of northern New York, I have been greatly aided by Mr. William Comstock, without whose coöperation I could have accomplished little or nothing, and also by Messrs. Henry L. Lawton and J. P. Steinhilber,[2] who gave me much practical information, and I desire, in closing, to acknowledge the services of these gentlemen.

National Museum, Washington, D. C.

BRIEFER ARTICLES.

Another death from eating Cicuta maculata.—Hon. Eugene Secor, of Forest City, this state, a member of the board of trustees of the Iowa Agricultural College, brought me to-day a fleshy root of a plant of the Water Hemlock (*Cicuta maculata* L.). The circumstances which brought it to his notice were as follows: A neighbor of his, by the name of Mr. Oleson,

[2] Mr. Steinhilber brought me two other plants which he said were becoming quite troublesome. The one was *Potentilla argentea* L., which I had seen abundant in the fields. The other was *Poterium Sanguisorba* L., which I had not seen, but which must have been introduced quite extensively into this country, as I found it in 1883 at Odenton, Md., and it has been found at Baltimore and at several points in New York state. I also have it from Mr. Martindale as a Philadelphia ballast plant.

a farmer about fifty years of age, while dragging some potato ground upon bottom land, about two weeks ago, discovered one of the fleshy roots of this plant, and supposing it to be an artichoke, ate of it and gave a portion to each of his two sons. He soon began to feel queer, or "funny," as he expressed it, and went to the house, where he was taken with a spasm, followed by two or three others, when he became unconscious, and within an hour, before a physician could be summoned from the village, two miles distant, he was dead. The children had probably eaten less of the root, and, being given an emetic, recovered. The plant is very common in the state, and the roots are so pleasant to the taste as to make it particularly dangerous. I may add that I ate a piece of the root of the size of a filbert with little or no unpleasant effect.—A. A. CROZIER, *Ames, Iowa.*

Floral eccentricities.—The artificial conditions which attend the growth of many cultivated plants sometimes induce very erratic development, especially in the organs of reproduction. These irregularities often persist in certain species and varieties, and may be regarded as vegetable vices which no human management can overcome. As an example, we may take the well-known habit of one of our common but beautiful June roses of sending out a cluster of buds from the center of its blossoms, and in rare cases to repeat the malformation in the secondary series.

Among the floral peculiarities that attracted my attention during the past summer was the branching of the scape of a double white tulip This forked about midway between the bulb and flower, and each branch bore an unusually large and symmetrically double blossom.

Another oddity was to be seen in an adjoining bulb bed. A plant of Crown Imperial (Fritillaria) had been transplanted late the previous autumn, and had evidently not yet recovered from the effects of removal. The root leaves developed finely, and the flower stalk grew about twelve inches and sent out the usual terminal cluster of leaves, beneath which the blossoms were represented solely by a dense fringe of cream white stamens without floral envelopes of any sort, or any organs resembling pistils or ovaries. The anthers were unusually large and full of pollen, and the plant was for many days a unique object and excited much interest.

A rather singular case of doubling in the common Portulaca grandiflora also came to my notice. Only the self-sown, single varieties were growing in the garden, and the blossom in question was on a plant which, aside from this specimen, bore only normal blossoms. This one, however, had in its center a monopetalous corolla like growth, the peculiarity of which lay in the fact that it was the pistil which was thus transformed, while the full complement of stamens encircled it.

I should like to inquire if it is not rather rare to find Cuscuta glomerata parasitic on plants outside of the Compositae? During the past year I have for the first time observed it on the poke-weed. The latter was in each instance apparently much reduced in size and vigor by its unusual attendant, but the dodder seemed to find in its new host all the conditions for luxuriant growth.—MARY E. MURTFELDT, *Kirkwood, Mo.*

Another phosphorescent mushroom.—Among a few hundred species of fleshy fungi which I collected in Watauga county, N. C., in the vicinity of Blowing Rock, during the month of August, 1888, was a very common species which was markedly phosphorescent. The species was referred to Prof. A. P. Morgan, who determined it as *Agaricus* (*Clitocybe*) *illudens* Schw. I had placed a large cluster at the base of a tree in front of the hotel. At night some of the guests noticed the phosphorescent light, and amused themselves by breaking the mushroom into bits and delineating, in the dark, mammoth, hideous figures. The phosphorescence resides in the hymenium, and probably in a portion of the hymenophore directly adjacent. Very young plants were phosphorescent, though not so bright as mature ones. I made several tests, but could find no phosphorescence in the stipe or in the fleshy part of the pilus. After collecting the plant, the phosphorescence continued as long as the hymenium was moist.—GEORGE F. ATKINSON, *Columbia, S. C.*

EDITORIAL.

THE DEMAND for illustrations to accompany the articles sent to the GAZETTE for publication is steadily increasing as the papers sent increase in importance and permanent value. Illustrations are particularly desirable in anatomical articles and those describing new species. We would be glad to illustrate all papers with lithographic plates, but the cost of these in this country is so great that this is impossible unless some kind friend wishes to endow this department of the GAZETTE. (There are worse uses to which money could be put.) For financial reasons, therefore, it is necessary that we confine the majority of our illustrations to the photo-engraved plate. As there is considerable labor involved in the preparation of drawings which are sent to us for the engraver, we beg to offer a few suggestions to authors regarding the matter. By attending to these hints their labor will not be increased, our own will be sensibly diminished and the final result will be more satisfactory.

Select for your drawing paper the heaviest and best quality of linen paper, such as is used by the manufacturers of blank books for bank ledgers. This gives the best satisfaction, for, in case erasures have to be made, this will stand scratching and rubbing without allowing the ink to spread. Next to this is the best bristol board. Usually the two sides of this are different, and care should be taken to use the right side. If it is desired to use much shading, the special stipple papers supplied by photo-engravers should be used with black crayon.

Make all line drawings twice the size that it is desired for them to appear. Drawings on the special stipple paper should be one-half larger

than they are to appear. By the reduction in photographing the lines are refined and some of the too common shakiness is eliminated. If line shading is employed the lines should not be closer than 35–50 to the inch.

If you can handle a pen so as to produce a smooth, even line, procure Gillott's No. 170 or 290, or, for still finer work, Keuffel & Esser's No. 1459. The sort of ink you use is of the utmost importance. It must make a *perfectly* black line, even the thinnest. Higgins' "American Drawing" or "photo-drawing" inks give such lines. No writing ink will do this.

If not sufficiently skillful with the pen, make drawings with a hard pencil on proper paper, showing all the lines you wish to appear and of the proper relative width.

Please do not make drawings on thin, soft paper, with pale ink, and of the size they are to appear.

All articles requiring illustrations, together with the drawings and all correspondence concerning illustrations, should be addressed to Charles R. Barnes, 712 Langdon street, Madison, Wis.

OPEN LETTERS.

Another "loco" plant.

I have just had handed me by the editor of our Montana *Stock Journal* a root with leaf buds on it, sent by a ranchman from Augusta, Montana, with the declaration that it is called "loco" weed, also "rattle weed," and that it is "killing horses."

The root and plant sent me is undoubtedly *Oxytropis lagopus* Nutt., and I am astounded to hear of its ill-repute at Augusta. I am so much astounded that I think a mistake must have been made by the ranchmen of Augusta in identifying the plant that does the mischief. Have your readers any knowledge of this matter? F. D. KELSEY.

Helena, Montana.

CURRENT LITERATURE.

Saccardo's Sylloge Fungorum.[1]

The volume of the Sylloge before us covers a specially interesting part of the field. In its preparation Prof. Saccardo has had the assistance of three excellent botanists. The Phalloideæ were taken by Ed. Fischer, and the remainder of the Gasteromyceteæ by Dr. DeToni. The Phycomyceteæ are made to include the Mucoraceæ, Peronosporaceæ, Saprolegnia-

[1] SACCARDO, P. A.—Sylloge fungorum omnium hucusque cognitorum: Vol. VII. Pars I, Gasteromyceteæ, Phycomyceteæ et Myxomyceteæ, digesserunt A. N. Berlese, J. B. De-Toni et E. Fischer. 498, XXX pp., roy. 8 vo. Patavii, 1888.—33 francs.

ceæ, Entomophthoraceæ, Chytridiaceæ and Protomycetaceæ, and have been elaborated by Drs. Berlese and DeToni. The Myxomyceteæ were also done by Dr. Berlese.

Like the preliminary numbers of the series, this volume includes descriptions of all species of the groups named, so far as known to the authors. The compilation will be of the greatest service to the student, and enable him to do more accurate work with less loss of time than was possible heretofore.

Of course, in groups receiving so much attention as these do at present, the volume is scarcely published before descriptions of new species and revisions of genera call for addenda. It is to be regretted that the fine paper by Roland Thaxter, on the Entomophthoreæ of the United States, containing nearly a dozen and a half new species, did not reach the authors in time to be included.

Volume VI, on the Hymenomyceteæ, although it should have preceded the present one, has been delayed, but is expected to be out soon. The second part of Volume VII, just issued, will be reviewed next month; it embraces the Ustilagineæ and Uredineæ. The series is to be concluded with volume eight.

Minor Notices.

In some recent notes[2] on vegetable pathology, Dr. F. Cavara describes Dendrophoma Marconii, which infests the stalks of Cannabis sativa; Pseudopeziza Trifolii, that attacks Trifolium repens, Medicago sativa, etc.; Pleospora Trifolii, also found on Trifolium repens; Botrytis parasitica, which seriously attacks tulips; Basiaschum Eriobothryæ, found on leaves of Eriobothrum Japonica; and Pestalozzia Banksiana, on leaves of Banksia robus. All, excepting Pseudopeziza Trifolii, are recorded as new species, while Basiaschum Eriobothryæ constitutes a new genus.

In a reprint entitled "Botanical Notes,"[3] Miss Mary K. Curran gives much interesting information concerning the Pacific flora. It is a wonderful, and in many respects a very perplexing flora, and only an abundance of material and patient study can settle the numerous questions that arise. In the first part of the paper before us a list of plants from Baja California, collected by Walter E. Bryant, is given. Among them is a new species of Gongylocarpus, which demands a modification of the generic characters. The second part gives a synopsis of the Papavereæ of the Pacific coast. Dendromecon is placed in Hunnemanniæ, and Platystigma is merged with Platystemon. The numerous species of Esch-

[2] Cavara, Dr. Fridiano.—Appunti di Patologia Vegetale: alcuni funghi parassiti di piante coltivate. Extract from the Instituto Botanico della R. Universita di Pavia. Large 8vo. 14 pp. 1 plate. Milan, 18·8.

[3] Curran, Mary K.—Botanical Notes. Reprint from Calif. Acad. 2d Ser. Vol. 1., pp. 227-269. Issued Dec. 13, 1888.

scholtzia described by Professor Greene are all reduced to E. Californica, for which full reasons are given. The third part is entitled "Miscellaneous Studies," chief among which is the discussion of Mimulus. The proposal to divide the genus by restoring Diplacus and Eunanus to generic rank is not approved, and the observations given, on the whole, confirm Dr. Gray's conclusions, although they somewhat modify his sections.

NOTES AND NEWS.

W. L. GOODWIN, of Queen's University, Kingston, records (*Can. Record Sci.*, Oct.) the survival of a pine tree after girdling.

GARDEN AND FOREST has begun an interesting series of articles upon the elements of vegetable physiology, by Dr. George L. Goodale of Harvard University.

DR. JULIUS VON SACHS, the well-known professor of botany and director of the botanic garden at Würzburg, has declined a call to the University at Munich.

DR. DAVID DIETRICH, author of the extensive "Forst-Flora" and curator of the herbarium of the University of Jena, died on the 23d of October, in the 90th year of his age.

THE LAST ISSUED part of the *Journal* of the Linnean Society continues Forbes' enumeration of the plants of the Chinese region. The list has just reached the Compositæ. Many new species are described.

IN REVIEWING Wigand's *Das Protoplasma als Fermentorganismus*, Dr. Goodale (*Am. Jour.* Jan.) refers to an expression the author once used in conversation, "my whole life has revolved around Tannin, Darwinism and Bacteria."

IN THE *Journal de Botanique* (Dec. 16) Van Tieghem writes of hydroleucites and aleurone grains, and Lagerheim (of Stockholm) describes (with colored plates) a new genus of Chytridiaceæ, parasitic upon the uredospores of certain Uredineæ.

MR. ARTHUR HOLLICK records (*Bull. Torr. Club*, Dec.) the discovery of Quercus heterophylla, the famous "Bartram Oak," at Tottenville, Staten Island, N. Y., and in the same connection gives an interesting review of the literature of this oak and also of *Q. Rudkini* Britton.

AN ABNORMAL Rudbeckia hirta is reported by O. A. Farwell, of Phœnix, Mich., in which there are nine small heads sessile in the axils of the involucral scales of an ordinary head. They are 3 to 20-flowered, with 2 to 6 rays, and have an involucre of 3 to 8 equal scales in a single row.

DR. BESSEY reports (*Am. Nat.* Dec.) that the notable weeds of the Nebraska plains are as follows, supposably in the order of their unpopularity: Cenchrus tribuloides, Solanum rostratum, Helianthus annuus, Hordeum jubatum, and the two tumble-weeds, Amarantus albus and Cycloloma platyphyllum.

THE GAZETTE discovers that it owes its readers an apology for the miserable wrapping of the December number. The thing was so unusual that it excited remark, and we do not wonder. Were it possible we would duplicate the abused numbers. It was simply one of those mistakes for which no one seems to be blameworthy, but which will not occur again.

IN A PRELIMINARY communication[1] regarding his experiments in the Tübingen laboratory on the effect of the lower oxygen pressure on the movements of potoplasm, James Clark shows that when the pressure is reduced to 1.2–3.0 mm. of mercury all movement quickly stops.

C. WARNSTORF, of Neuruppin, Germany, asks the directors of herbaria and all bryologists to aid him with material for study of the Sphagnaceæ of foreign countries. He promises to use submitted material with the utmost care, and, unless otherwise specified by the sender, to return it after examination. He has in contemplation a *Sphagnologia Universa*. As Warnstorf is already known as one of the most thorough students of this perplexing group, we hope he will meet with a generous response to his request.

STAHL (*Bot. Zeit.* 1880) states that in Lemna trisulca the chlorophyll grains, which in ordinary diffused light are ranged upon the two walls of each cell lying parallel to the frond's surface, at night are driven to the side walls or lowest wall, leaving the superficial one bare. Mr. Spencer Le M. Moore (*Jour. Bot.* Dec.), in his observations on the subject, differs somewhat from these conclusions. His results show that while many of the grains are driven by darkness from the superficial to the side walls, many of them still remain on the superficial wall. This subject of photolysis is a very interesting one, and observers having duck-weed convenient would find in it a profitable field of investigation.

IN THE SEVENTH part of the Proceedings of the German Botanical Society (p. 248), Frank sums up his preceding observations and researches on mycorhiza, which go to show that the fungus of mycorhiza acts as a transporter of nourishment for the plants. Mycorhiza is most widely distributed. Specimens of tree roots from the most diverse parts of the world exhibit it, and the number of sorts of trees on which it has been found is now very large. (In the proceedings of the same meeting is published a paper by Alb. Schlicht, listing forty seven more species of herbaceous plants on which it occurs.) Mycorhiza is dependent for its development on the presence of humus in the soil, and therefore the fungus can not be a true parasite. The further facts that the roots at no time of year are free from the fungus, that roots thus invested do not perish sooner than others, and that cultivation experiments with beech seedlings show them poorly nourished without mycorhiza even in humus itself, all go to establish the symbiotic character of the association.

DR. ADAM PRAZMOWSKI discusses in an address delivered before the biological section of the Congress of Polish naturalists,[2] the nature and function of the root tubercles of the Leguminosæ. He has been unable to confirm Ward's observations as to the nature of the "bacteroid" bodies and the fungus itself. He considers that the tubercles are due to the attack of a special organism which may be said to belong to the fungi in the widest sense, but is not a hyphal fungus (Hyphenpilz), although in its young stage it occurs in the form of hypha-like filaments, which collectively form a sort of mycelium. It does not possess the characteristic membrane of the fungi, and in its older stages forms a sort of plasmodium. In many ways it approaches such Myxomycetes as Plasmodiophora Brassicæ. As to the bacteroid bodies themselves, Prazmowsk thinks that they can not be germs, because he has observed the formation of spores in the older and injured tubercles only, and because these

[1] Berichte d. deutsch. bot. Gesells. vi. 273.

[2] See the Botanisches Centralblatt xxxvi. 215, 248, 280.

bacteroids remain unchanged even after disorganization and putrefaction of the tubercles has occurred. The relation between the fungus and the host he considers one of symbiosis.

VOIGT HAS RECENTLY published his researches on the growth and development of seeds with ruminated endosperm belonging to the Palms, Myristicaceæ and Anonaceæ of Java. Among the Palms he distinguishes two cases: (*a*) with the prolongations of the seed coats cylindrical, without connection with the fibro vascular bundle of the testa, beginning at or before fertilization; (*b*) with the prolongations plate-like, or when less developed, swellings or ridges of greater or less breadth, inserted over the fibro vascular bundle of the testa and receiving twigs from it. In Myristica fragrans the ovule has two integuments, but the inner covers only the upper part of the ovule. Soon after the opening of the flowers most of the tissues of these integuments and the nucellus passes over into permanent tissue, only the lower part of the outer integument and the lower part of the nucellus remaining meristematic. In the base of the nucellus, which grows very rapidly after fertilization, an outer layer (next the outer integument) and an inner layer (next the embryo sac) become permanent tissue, the former finally forming part of the testa. In this first mentioned layer a much branched vascular system develops connected with the vascular bundle of the rhaphe. Over the twigs of this vascular system arise projections which push themselves inwards deeply into the endosperm. In Anonaceæ the plates producing the "rumination" arise in four vertical rows by local growth of the outer integument. Each plate is thin and quadrant-shaped, with the central angle rounded. One of each row stands at the same height. A fuller abstract will be found in the *Botanisches Centralblatt*, xxxvi, 1344

DR. J. H. WAKKER has an important paper in the final part of the nineteenth volume of Pringsheim's *Jahrbücher*, entitled, "Studien über die Inhaltskörper der Pflanzenzelle." The following translation of his summary of results will give an idea of the scope of the paper:

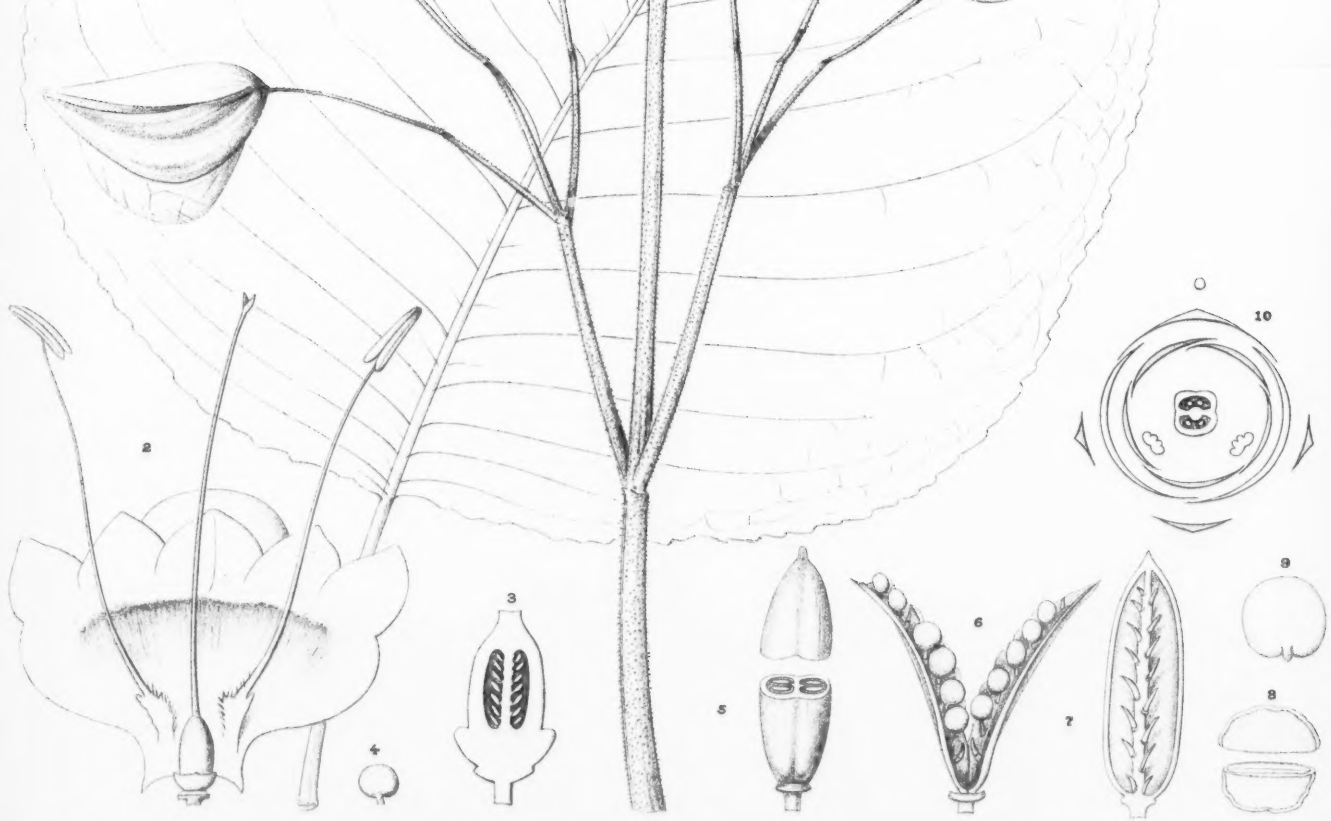
"Calcium oxalate crystals which are found inside the plant cell are formed exclusively in the vacuoles. The dragging of the crystals around by the movements of the plasma does not conflict with this fact [because in this case the vacuole divides and a small vacuole surrounds each crystal]. Aleurone grains are vacuoles filled with proteids. By the drying of ripening seeds the proteids become solidified, and by the softening which precedes germination the reverse takes place. In the formation of seeds the originally single vacuole divides into many, and in germination the reverse occurs, so that the emptied cells of the germinated seed again contain a single central vacuole. The proteids dissolved in the cell sap of ripening and germinating seeds can be precipitated by several reagents, viz.: dilute nitric acid, absolute alcohol, salt solutions, etc. By using these substances one can follow, step by step, the slow disappearance of the proteids in seeds kept in the dark. Globoids are formed in the vacuoles. Crystalloids can be formed in different places, viz.: in the vacuoles, the plasma, the nuclei or the plastids. Fixed oil is always formed in the plasma; either in specialized bodies (elaioplasts), or distributed through the plasma as in seeds. Plasma, during plasmolysis, can be perforated without causing its death."

It will be observed that this paper, together with that of Went, on the origin of vacuoles, in the preceding part of the same publication (see this journal, xiii, 280), extend our knowledge of the vacuole enormously, and show that it is much more than a space in the protoplasm formed by its inability to keep up with the growth of the cell wall.

C.E. Faxon, del.

BLAKEA GUATEMALENSIS n. sp.

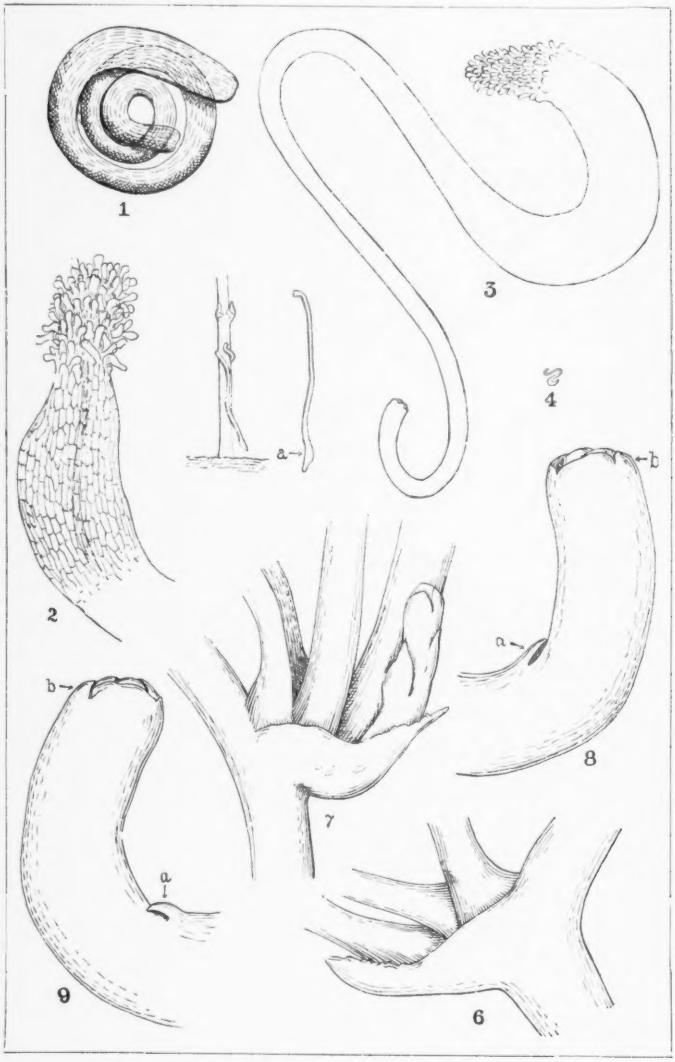
B. Meisel, Lith. Boston.



C. E. Faxon, del.

LOUTERIDIUM DONNELL-SMITHII, Watson.

B. Meisel, Lith. Boston.



HOOKER on CUSCUTA GRONOVII.